

# AN AIR-LIFT CIRCULATOR FOR ALGAL CULTURE TANKS<sup>1</sup>

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## ABSTRACT

The water circulator described in this paper is a new device used in algal culture tanks at the Galveston Laboratory. The principle of the air-lift pump is incorporated into this apparatus which, when in operation, creates directional laminar water flow in rectangular tanks. Advantages include: 1) elimination of mechanical pumps, agitators, and electrical supply; 2) total water circulation that exposes all algal cells to light source and prevents cells from settling to bottom; 3) even distribution of nutrients; and 4) power source that provides air essential for algal growth.

## INTRODUCTION

Because of increasing demands for algal foods used in rearing larval fish and shellfish, there is interest in increasing production of mass-culture facilities. The water circulator described in this paper is a new device developed at the Galveston Laboratory for use in the mass culture of algal foods.

Adequate circulation of water is needed in algal cultures to insure that all cells are exposed to the light source (Fogg, 1965), and to provide equal distribution of nutrients. Also

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proper water circulation prevents the accumulation of cells on the bottom of culture tanks. This circulation is usually accomplished with mechanical pumps or agitators which require frequent maintenance, an electrical power source, and must be constructed of nontoxic materials.

Circulation can also be achieved with compressed air, either with air stones or in an air-lift pump. Compressed air used to operate an air-lift pump serves two purposes. First, the air essential for growth of green plants (Fogg, 1970) is provided. Second, it is the power source for the air-lift pump. This pump is the most trouble-free method of moving water, having no working parts, little initial expense, and needing little or no maintenance.

#### THE PRINCIPLE OF THE AIR-LIFT PUMP

Spotte (1970) describes the principle of the air-lift pump which is incorporated into the circulator described in Figure 1. This prototype was designed for use in a 300-liter tank with the dimensions of 90 x 58 x 60 cm. Materials used include the following: plexiglas<sup>2</sup> sheet, 6.4 mm thick; plexiglas rods, 9.5 mm in diameter; plexiglas solvent; silicone cement; PVC pipe, 6.1 cm in diameter; rubber bands, size 64; nylon nuts, bolts, and washers; plastic tubing, 6.4 mm diameter; airline clips, 6.4 mm; and millionaire air stones.

The vertical chamber with an inlet slot at the bottom and a directional discharge slot at the water surface is the "pipe" of the air-lift. When an air stone is placed inside the chamber near the inlet slot and air forced through it, the resulting action is a laminar flow of water causing a continual turnover of the water in the tank. An air flow of 8 liters per minute at a pressure of .98 kg/cm<sup>2</sup> is sufficient for optimum circulation. The result is a water flow of 510 liters/min. through the circulator at the maximum culture volume of 300 liters.

The section of plastic pipe (deflector) at the top of the water circulator provides the desired directional flow. To achieve the same circulation at shallower water depths, a second deflector is placed into one of the lower discharge slots. Rubber bands attached to the notches on the plastic pipe hold the deflector in place.

The circulator is cleaned by rinsing thoroughly with a dilute solution of nitric acid, rinsing with tap water, scrubbing with soapy water, and a final rinsing with tap water. The circulator is placed inside the culture tank and sterilized as described by Griffith (1971).

<sup>2</sup>The use of trade names in this publication does not imply endorsement of commercial products.

Skeletonema sp., Thalassiosira sp., and Cyclotella sp. are examples of algal foods cultured successfully using this circulator. In addition to these applications, the circulator has been used successfully in culturing larval and postlarval penaeid shrimp.

#### LITERATURE CITED

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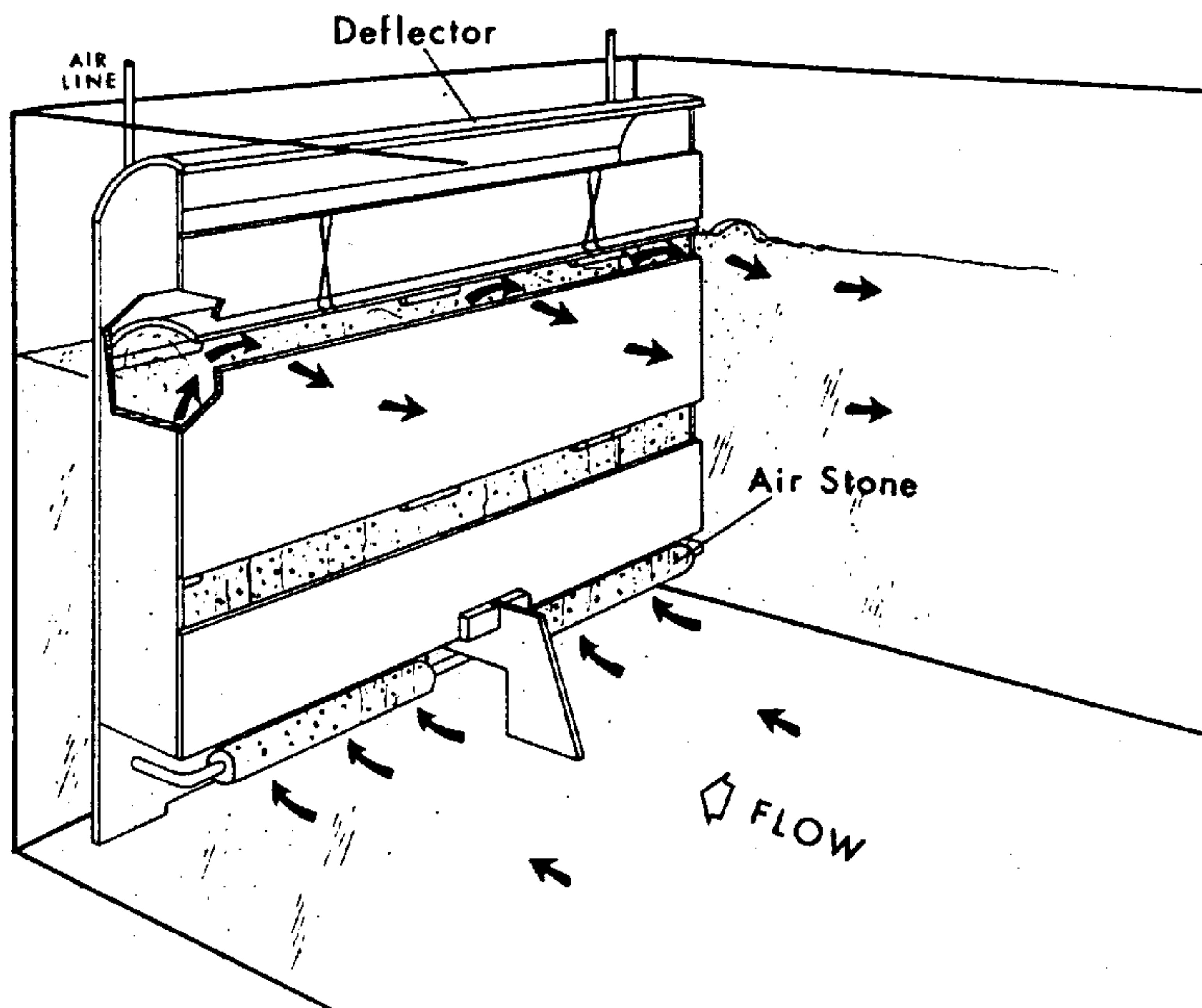


Figure 1. Air-lift circulator and the normal flow pattern.